Third Five-Year Review Report

for

Southwest Ottawa County Landfill

Park Township

Ottawa County, Michigan

September 2003

PREPARED BY:

Michigan Department of Environmental Quality
Lansing, Michigan
and
United States Environmental Protection Agency
Region 5

Approved by

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William E. Muno, Director
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U.S. EPA, Region V

Date: 9/27/03

Third Five-Year Review Report

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Attachments

List of Acronyms

AOC	Administrative Order of Consent
ARAR	Applicable or Relevant and Appropriate Requirements
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMSPP	Comprehensive Monitoring and Sampling Protocol Plan
CFR	Code of Federal Regulations
COC	Contaminants of Concern
GEOS	Groundwater Evaluation and Optimization System
GRA	Groundwater Restoration Agreement
MDNR	Michigan Department of Natural Resources
MDEQ	Michigan Department of Environmental Quality
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
RPM	Remedial Project Manager
PN	Prein and Newhof
ppb	Parts per billion
RA	Remedial Action
RD	Remedial Design

RI/FS	Remedial Investigation/Feasibility Study
RP	Responsible Party
SWOCLF	Southwest Ottawa County Landfill
TCE	Trichloroethylene
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

Executive Summary

The remedy for the Southwest Ottawa County Landfill (SWOCLF) site (the site) in Park Township, Michigan, included the capping and fencing of the landfill, the installation of two extraction wells at the southwest corner and south of the landfill (used as a source control), and the installation of a second extraction well line southwest of the landfill along James and 168th Streets. An activated carbon adsorption and iron removal pump and treat system was also incorporated with the second extraction well line. Treated water is discharged to an unnamed creek, which flows into Lake Macatawa in accordance with a National Pollution Discharge Elimination System (NPDES) permit. Currently, there are 115 monitoring wells installed around and downgradient of the site. Ottawa County, the responsible party (RP), performed groundwater sampling quarterly from 1985 to 1994, then annually from 1995 to the present time. The groundwater samples are analyzed for the following contaminants as listed in the 1985 Groundwater Restoration Agreement (GRA): benzene, ethyl benzene, xylene, chlorobenzene, 1,1-dichloroethane, 1,2-dichloroethane, methylene chloride, diisopropyl ether, and total iron. The GRA established criteria for each contaminant of concern (COC) listed. The treatment system may be bypassed with direct discharge of the extracted groundwater once concentrations are documented to be below the criteria as stated in the GRA.

The site achieved construction completion with the signing of the Site Close Out Report dated September 22, 1994. The First-Five Year Review, written by the United States Environmental Protection Agency (U.S. EPA) was completed on September 25, 1995. The second Five Year Review, also written by the U.S. EPA, was completed on October 27, 1997. U. S. EPA concluded at the time of the first review that the pump and treat remedy selected for the site was protective of human health and the environment. In the 1997 review, U. S. EPA concluded that the GRA was protective of human health and the environment although significant questions were presented concerning the effectiveness of the current pump and treat/purge system. The State has documented that since 1987, the pump and treat/purge system has not met compliance with the GRA.

In the mid 1990's, the State, based upon the sampling data, raised several concerns about the adequacy of the treatment system. Among these were: the pump and treat/purge system was not adequately capturing and treating the groundwater plume; the data suggested the extraction wells were not effective in capturing the target contaminant plume; elevated levels of contaminants appeared to be migrating towards Lake Michigan, as well as to residential well areas located along Lake Shore Drive; Prein and Newhof (PN), the RP's consultant, was not using the required low flow method for the collection of the groundwater samples; and the lack of analysis for the presence of additional heavy metals contaminants within the groundwater plume. Since the GRA stated that the RP was required to adjust and improve the remedy as needed, the State requested the RP address these issues by conducting an encompassing hydrogeological investigation to determine if the above concerns were valid. The RP

refused to undertake any corrective actions. Finally, negotiations failed and the State filed a lawsuit against the RP in April 2000 for failure to comply with Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Part 201) and for cost recovery of State funded investigations.

This Five-Year Review was delayed for one year due to the on-going litigation between the State and the RP. During this time the State was able to perform fieldwork for a hydrogeological investigation. A contractor was obtained in 2002, and field investigations were completed in April and May 2003.

The State's assessment of this Five-Year Review and the analytical data collected from the hydrogeological investigation, found that the current pump and treat/purge system is unsuccessful in containing the entire target contaminant groundwater plume. The State's assessment located a significant groundwater contaminant plume migrating from the south and southwest corner of the landfill containing the following contaminants above criteria for both the GRA and Part 201: benzene, chlorobenzene, diethyl ether (ethyl ether), tetrahydrofuran, chromium, lead, and iron. These same contaminants were also detected in other downgradient monitoring wells at concentrations above criteria.

As a part of the Region 5 Groundwater Evaluation and Optimization System (GEOS), U.S. EPA conducted two reviews of the site data. The September 24, 2003, report "Analysis of Hydraulic Capture – South West Ottawa County Landfill", reviewed the adequacy of the pump and treat extraction system's ability to capture the target contaminate plume. The September 12, 2003 "Statistical Analysis Summary for the Southwest Ottawa County Landfill Site" report was a statistical analysis of the historical groundwater data. Their principal conclusions were that the hydraulic capture is not adequate and there is insufficient data to determine how inadequate the system is operating.

No hydrogeologic limiting issue has been discovered that would prevent the pump and treat/purge system from functioning as intended. U.S. EPA believes that the remedy would function as intended if an adequate number of extraction wells are installed and they pumped at an adequate rate.

Ottawa County has set up controls to prevent exposures. Ottawa County and Park Township have completed the installation of a municipal water supply system in potential receptors areas where residential wells are in use. The water supply system was installed along Lake Shore Drive, James Street and 168th Street. The Ottawa County Health Department conducts residential well sampling three times a year. The County provides free hookup to the municipal water supply system for any contaminated residential well.

Protectiveness cannot be determined until further information regarding current exposure pathways are obtained. The timeframe necessary make the final determinations is expected to be no more than three months. In order for the remedy to be protective in the long-term, follow-up actions need to be taken to eliminate potential threats. Long-term follow-up actions needed include: providing free municipal water supply system hookups for all potential receptors with residential wells in use; adequate information needs to be provided on the current operations of the pump and treat/purge system and monitoring network; the pump and treat/purge system needs to be augmented (including additional extraction wells and increased total pumping) to achieve capture of the target contaminant plume; and the monitoring network needs to be augmented to provide additional information on the long-term performance of the pump and treat/purge system.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Southwest Ottawa County Landfill		
EPA ID *(from WasteLAN)*: MID980608780		
Region: 5	**State: MI**	**City/County: Park Township/Ottawa County**

SITE STATUS	
NPL status: ☒ Final ☐ Deleted ☐ Other (specify): _____	
Remediation status (choose all that apply): ☐ Under Construction ☒ Operating ☐ Complete	
Multiple OUs?* ☐ YES ☒ NO	**Construction completion date:** August 3, 1987
Has site been put into reuse? ☐ YES ☒ NO	

REVIEW STATUS	
Lead agency: ☐ EPA ☒ State ☐ Tribe ☐ Other Federal Agency _____	
Authors name: Cindy Fairbanks; David Wilson	
Authors title: EQA12; RPM	**Affiliation: MDEQ-RRD-Superfund; U.S. EPA Superfund**
Review period:** January 2, 2002 to September 30, 2003	
Date(s) of site inspection: October 22, 2002	

Type of review:
☐ Post-SARA ☒ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL RA Site ☒ NPL State/Tribe-lead
☐ Regional Discretion _____

Review number: ☐ 1 (first) ☐ 2 (second) ☒ 3 (third) ☐ Other (specify) _____

Triggering action:
☐ Actual RA Onsite Construction at OU #____ ☐ Actual RA Start at OU#____
☐ Construction Completion ☒ Previous Five-Year Review Report
☐ Other (specify) _____

Triggering action date *(from WasteLAN)*: October 27, 1997

Due date *(five years after triggering action date)*: October 27, 2002

* ["OU" refers to operable unit]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN]

Five-Year Review Summary Form, cont'd.

Issues:

The operating pump and treat system implemented under the GRA is not capturing and treating the entire plume. The State contends the system has been inadequate since 1987. State suggested improvements have not been incorporated by the RP. The investigations conducted as part of the Five-Year Review concluded that the pump and treat system was not capturing the entire target contaminant plume. They showed that the system is allowing breakthrough of the groundwater plume in at least one location and that contaminants above criteria are migrating beyond the pump and treat/purge line towards Lake Michigan and residential wells located along Lake Shore Drive. The additional groundwater pumping required to contain the entire plume will likely require more capacity than the current treat system has. The RP is not providing adequate information on the current operations of the pump and treat/purge system and monitoring network to adequately determine remedy performance. A well assessment and maintenance plan required to ensure that the pumping rate continue at an adequate rate has not been developed.

Not all of the residents with wells down gradient from the SWOCLF have been hooked up to the municipal water supply.

Recommendations and Follow-up Actions:

The following is recommended to eliminate potential threats and exposures: all potential receptors with residential wells in use that are down gradient of the SWOCLF site need to be provided free hookup to the municipal water supply system; The pump and treat/purge system needs to be augmented in order to adequately capture the entire target contaminant plume (this requires additional extraction wells and increased total pumping); the RP needs to provide adequate information on the current operations of the pump and treat/purge system and monitoring network; and the monitoring network needs to be augmented to provide additional information necessary to determine the long-term performance of the pump and treat purge system. In addition, a well assessment and maintenance plan required to ensure that the pumping rate continue at an adequate rate needs to be developed.

Protectiveness Statement(s):

Protectiveness cannot be determined until further information regarding current exposure pathways are obtained. The timeframe necessary make the final determinations is expected to be no more than three months. In order for the remedy to be protective in the long-term, follow-up actions need to be taken to eliminate potential threats. Long-term follow-up actions needed include: providing free municipal water supply system hookups for all potential receptors with residential wells in use; adequate information needs to be provided on the current operations of the pump and treat/purge system and monitoring network; the pump and treat/purge system needs to be augmented (including additional extraction wells and increased total pumping) to achieve capture of the target contaminant plume; and the monitoring network needs to be augmented to provide additional information on the long-term performance of the pump and treat/purge system.

Other Comments:

The State filed a lawsuit against the RP in April 2000 The lawsuit contends that the current treatment system is in non-compliance with Part 201 criteria The case has not gone to trial and attempts to negotiate a settlement out of court are on going

Five-Year Review Report

I. Introduction

The Purpose of the Review

The purpose of this five-year review is to determine whether the remedy at the SWOCLF site is protective of human health and the environment. The methods, findings, and conclusions of this review are documented in this Five-Year Review Report. In addition, the Five-Year Review Report identifies issues found during the review, if any, and recommendations to address them.

Authority for Conducting the Five-Year Review

The Michigan Department of Environmental Quality (MDEQ) and U.S. EPA are preparing this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act, 1980 PL 96-510 (CERCLA), §121 and the National Contingency Plan (NCP). CERCLA §121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The agency interpreted this requirement further in the National Contingency Plan (NCP); 40 Code of Federal Regulations §300.430(f)(4)(ii) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

The MDEQ and U.S. EPA have conducted a five-year review of the remedial actions implemented at the SWOCLF site in Park Township, Ottawa County, Michigan. This review was conducted from January 2002 through September 2003. This report documents the results of the review. The MDEQ conducted the Five Year Review with a Cooperative Agreement Grant provided by the EPA.

This is the third five-year review for the SWOCLF site. The triggering action for this report is the date of the second Five Year Review dated October 27, 1997 This five year review was conducted as a matter of policy because the selected remedy was pre-SARA but hazardous substances, pollutants, or contaminants will remain on site above levels that allow for unlimited use and restricted exposure. Also, this Review helped in answering questions posed during the previous reviews.

II. Site Chronology

Table 1: Chronology of Site Events

Event	Date
Initial discovery of migration of off site contamination. MDNR samples from original 14 monitoring wells detected heavy metals and leachate entering groundwater from southwest corner of the landfill.	1978
Trichloroethylene (TCE) found in residential well downgradient of the landfill.	1979
Ottawa County extends municipal water supply line along James and 168th Streets, downgradient of the landfill.	1980 – 1981
Operation of the landfill ceased by administrative action initiated by the State (Consent Decree). Proper closure of the site includes: immediate closure of the landfill; final landfill cover/capping; installation of pump and treat/purge system; monitoring; alternate water supply for affected residents.	1981
Site is placed on the National Priorities List	1983
GRA negotiated and signed by State and Ottawa County, detailing remedial actions and remedy to be undertaken.	1985
Record of Decision (ROD) GRA, included public participation and combined the function of a ROD and an enforcement agreement for Remedial Design and Remedial Action.	1985
On site construction. landfill capped, treatment system and seven extraction wells began operation, and treated water is discharged to nearby tributary under a NPDES permit.	1986 – 1987
State gives first notice county is out of compliance with the GRA and the remedy, as implemented, is not adequate.	1987
First detections of contaminants in residential wells along Lake Shore Drive , downgradient of both the landfill and extraction well line.	1993
Preliminary Site Close Out Report for SWOCLF.	1994
First Five Year Review	1995
Second Five Year Review This review was expedited due to the fact the first review was conducted beyond the initial review date.	1997

Table 1: Chronology of Site Events

Event	Date
State files lawsuit against Ottawa County for failure to meet the requirements of Part 201, including improvement to treatment and pump and treat/purge well system and refusing to conduct hydrogeological investigation.	2000
Fieldwork for a State funded hydrogeological investigation was completed.	2003
U.S. EPA reports "Analysis of Hydraulic Capture – South West Ottawa County Landfill" and "Statistical Analysis Summary Southwest Ottawa County Landfill".	2003

III. Background

Physical Characteristics

The SWOCLF site is a 43 acre landfill located approximately one-quarter mile southwest of the corner of Riley Road and 160th Avenue in Park Township, Ottawa County the responsible party (RP), near Holland, Michigan. The landfill is approximately one and a quarter miles east of Lake Michigan and two miles north of Lake Macatawa. The landfill is surrounded by residential homes to the east, north and west. South of the landfill the majority of the land is utilized for blueberry fields or is undeveloped. The Waste Management/Holland Lagoons (formerly Jacobussee Refuse Service Company) NPL site is southwest of the landfill. There is a county hiking trail park adjacent to the north, west and south of the site, which is used year round by area residents Site maps are provided in figure 1 and 2.

Land and Resource Use

The landfill was constructed by Ottawa County in 1966 and was operated as a licensed landfill by the Ottawa County Road Commission from 1966 until its closure in 1981. The landfill received solvents, heavy metals, paint sludges, oils, municipal refuse, and drums containing unspecified wastes. In 1970, the facility was leased to South Ottawa Disposal Corporation, which became a subsidiary of the Michigan Division of Waste Management Systems, Incorporated. During 1969, waste deposited in the landfill was suspected to be below the water table, which is at a depth of approximately ten feet. A groundwater investigation conducted by Prein and Newhof (PN), the PR's contractor, in 1979 indicated that landfill leachate was being generated, resulting in contamination of the underlying aquifer. The State ordered the site closed in 1981. Conditions of the enforcement action closing the site required that the RP cover the landfill with an acceptable cap, install and operate a treatment system to address the contamination plume migrating from the landfill, and provide residences with potentially affected private wells downgradient of the site with connections to the municipal water system. The landfill was capped with a three to six inch mixture of bentonite and natural sand, toped with ten to 18 inches of sand, then seeded with dune grass in 1981.

The groundwater aquifer underlying the site is a primary source of drinking water for those residents who remain unhooked to the municipal water supply system. The groundwater flow is to the southwest towards nearby Lake Michigan.

History of Contamination

Groundwater contamination associated with the landfill was identified in 1978 through the hydrogeological monitoring program required by the Michigan Department of Natural Resources (MDNR) under the licensure provisions of the Solid Waste Management Act, 1978, PA 641, as amended. Landfill leachate resulted in the

contamination of the underlying aquifer with benzene, xylene, other volatile organic compounds, and iron.

Initial Response

A residential well located on 168th Street, west and downgradient from the landfill, had elevated detections of TCE found in 1979. This prompted the PR to install a municipal water line along James and 168th Streets and to provide hookups of residences to the water supply several years later.

The RP completed a preliminary FS for treating the groundwater contamination in August 1980.

In 1981, the State and the RP entered into a Consent Order, which required closure and capping of the landfill, and residences with potentially affected wells to be connected to the municipal water supply system. Treatment of the groundwater contamination from the landfill was not covered by this consent order. Because of this, the site was included on the NPL in September 1983. The SWOCLF site was designated a State-Enforcement lead site under the Superfund Program.

Basis for Taking Action

A groundwater investigation conducted by PN in 1979 indicated that landfill leachate was being generated from the SWOCLF, resulting in contamination of the underlying aquifer. The groundwater aquifer underlying the site is a primary source of drinking water for those residents who remained unhooked to the municipal water supply system. It was determined that exposure to contaminated groundwater was the principal threat to be addressed by the GRA.

IV. Remedial Actions

Remedy Selection

In March 1984, a Preliminary Remedial Action Plan was submitted to the MDNR, which recommended groundwater extraction and treatment. On January 15, 1985, the MDNR signed a Groundwater Restoration Agreement (GRA) with the Ottawa County Board of Commissioners. This agreement combined the functions of a Record of Decision (ROD) and an enforcement agreement for the Remedial Design and Remedial Action phases of the process.

The remedy selected to meet the objectives of the GRA included a multi-well groundwater extraction system, groundwater treatment by activated carbon adsorption for removal of volatile and halogenated organic compounds and by chemical oxidation

and filtration for removal of iron, and regularly scheduled groundwater monitoring and monitoring of the treatment system influent and effluent. The system began operation in 1987.

Remedy Implementation

Remedial Action (RA) activities undertaken by the RP, with MDNR/MDEQ oversight, at the SWOCLF site was implemented under the Preliminary Remedial Action Plan and the GRA. The RA goals were to minimize risks to public health and the environment from use of and contact with contaminated groundwater and to prevent migration of contaminants into Lake Michigan at concentrations above criteria. The remedy selected to meet these objectives included the following:

- A multi-well groundwater extraction system. Two source control extraction wells were located due south and southwest of the landfill boundary. A second line of extraction wells was located downgradient southwest of the landfill along the intersection of James Street and 168th Street.

- Groundwater treatment by activated carbon adsorption for removal of volatile and halogenated organic compounds and by chemical oxidation and filtration for removal of iron.

- Discharge of treated water to surface waters under a National Pollutant Discharge Elimination System (NPDES) permit.

- Monitoring of the treatment system influent, effluent, discharge and monitoring wells according to a schedule included in the agreement. The purpose of the monitoring plan is "to demonstrate the effectiveness of the pump and treat/purge well system in intercepting, capturing and purging contaminated groundwaters."

On-site construction of the pump and treatment system began approximately July 30, 1986, and was completed on or before July 30, 1987. The treatment system and seven extraction wells began operation in August 1987. The treatment system is designed to remove volatile organics through activated carbon adsorption and iron removal by chemical oxidation and filtration. Treated water is discharged to an unnamed tributary of Lake Macatawa under an NPDES surface water discharge permit. A network of monitoring wells is used to determine capture of the target contaminant plume and on-going groundwater quality. The original groundwater pump and treat/purge consisted of seven extraction wells. Selected wells in the network of 115 wells are used for monitoring. See Figure 3 for location of monitoring wells (MW-XX) and groundwater extraction wells (PW-XX.)

The GRA listed the acceptable concentrations of organic and inorganic contaminants to be achieved in the groundwater. Once those concentrations were achieved, bypass of activated carbon absorption and/or iron treatment systems would be allowed.

System Operations / O&M

The pump and treat/purge system was originally designed with 7 wells intended to pump approximately 100 gpm, a treatment system with a capacity of 700 gpm, and an NPDES permit allowing 1 MGD (equivalent to about 750 gpm). The wells were installed and tested in 1986, and construction was completed in 1987. As early as 1987, MDEQ gave its first notice to the RP that the system was out of compliance with the GRA and proposed a 10-well system. In 1990, an additional extraction well, PW-8, was installed between wells PW-3 and PW-4 to capture groundwater that was not being captured by the two extraction wells.

In August 1992, the Leachate Purging and Treatment Systems Comprehensive Monitoring and Sampling Protocol Plan (CMSPP) was amended and clarified. The purpose of this change to the CMSPP was to identify changes and refinements to the pump and treat/purge system. These included: additional extraction wells; additional monitoring wells to monitor the effectiveness of the pump and treat/purge system and restoration of the groundwater; and an amendment to the method of determining the suitability for extraction wells to bypass the treatment system.

In 1992 two additional extraction wells, PW-9 and PW-10, were installed in the gap between wells PW-7 and PW-6, and between PW-6 and PW-5, respectively. However, after the pump and treat/purge system was increased from 7 to 10 wells, the treatment plant capacity was not increased. Therefore, it appears that the overall volume of pumping did not increase. Even though additional extraction wells were installed, the State contends the system is still not adequately modified to capture and treat the contaminant plume migrating from the landfill.

The RP has not provided the individual well pumping rates, the treatment plant flow rate, nor the total system flow rate. This information is required to be submitted by the GRA and in addition, the State has requested that the RP provide this information.

Because no observed flow rates are available, it can not be determined from the published data whether the actual pumping rates are consistent with the design.

Currently, the treatment system continues to operate both the carbon adsorption and the chemical oxidation and filtration system with limited efficiency and in non-compliance with Part 201. All required treatment system monitoring and analysis, as stated in the GRA, are being performed.

Based on groundwater monitoring data, the State determined the pump and treat/purge system appears to not be controlling the migration of the contaminant plume. The first contaminants detected in residential wells along Lake Shore Drive, downgradient of both the landfill and the treatment system, were discovered in 1991. Bottled water was distributed to residences with affected wells. The area of private well sampling continued to expand as additional wells were contaminated. A municipal water supply line was installed along Lake Shore Drive in the 1990's. Residences with contaminated wells were hooked into the municipal supply at no charge while those unaffected had the option of paying for the hook up or continued use of their private wells to obtain drinking water. The county health department continues to conduct residential well sampling three times a year.

The latest annual report, from 2001 continues to support the conclusion that portions of the target groundwater plume (groundwater above the GRA criteria) is not being captured by the treatment system and migrating towards residential wells along Lakeshore Drive and Lake Michigan.

The State and RP conducted negotiations from 1996 until 2000 in an attempt to convince the RP to institute improvements to the treatment system. An impasse was reached and the State filed a lawsuit against the RP in April 2000.

V. Progress Since the Last Five Year Review

There were three recommendations presented in the last Five-Year Review of October 27, 1997.

1) Have the RP demonstrate the capture area for each extraction well and determine if the entire target capture zone (contaminated groundwater above standards) was being captured. No progress has occurred concerning the first recommendation. The RP has not provided a demonstration of the capture area.

2) Determine which residential wells, existing monitoring wells and new monitoring wells need to be sampled to determine the source and extent of inorganic contamination. Take immediate and long-term action as necessary to protect human health based on any inorganic contamination. The RP and Park Township have completed the installation of a municipal water supply system to potential receptors areas where residential wells are in use. The water supply system was installed along Lake Shore Drive, James Street and 168th Street. The Ottawa County Health Department conducts residential well sampling three times a year. The RP provides free hookup to the water supply system for any contaminated residential well. Additional analytical data from the investigation performed by the State in April/May 2003 indicates groundwater contaminantation containing lead and iron above current State standards. The GRA has not been amended, nor has the RP included the recommend list of inorganic contaminants into its groundwater monitoring program.

3) Review the selected remedy in light of new State standards, questionable effectiveness of the pump and treat/purge system's ability to capture the target plume and newer remedial options. No new information has been made available to show the new State standards would limit the effectiveness of the pump and treat/purge system's ability to capture the target plume, provided the overall pumping rate would be increased and additional extraction wells installed.

The State has been trying to bring the RP's remedy into compliance with State law and the GRA.

MDEQ staff met with RP representatives in 1996 to discuss upgrading the extraction wells and the treatment system, the existing landfill cap, and to expanding the annual groundwater sampling to include analysis for additional contaminants, specifically heavy metals. Numerous negotiations were held between the RP and the State from 1996 into 2000 with no resolution of the outstanding issues, which are described below:

- The landfill (source control) pump and treat/purge capture system is inadequate. Other heavy metals, besides, iron, are contaminants of concern (i.e., barium, cadmium, chromium, manganese, lead, and vanadium)..
- The second downgradient (line) pump and treat/purge capture system has failed to contain the contaminant plume. Breakthrough of the system has been documented and conceded to by the RP. The pump and treat/purge system has been unable to function at full capacity due to iron fouling and inadequate spacing of the wells.
- Promised proposals from the RP to address the pump and treat/purge capture system, to expand the sample analytical for metals and to replace the landfill cap have not been submitted or have been made in incomplete proposals.
- The RP wished to shut down and abandon the downgradient pump and treat/purge well capture system, which would allow contamination to proceed unabated into Lake Michigan.
- Downgradient private drinking water wells along Lakeshore Drive and Lake Michigan are still at risk from the migrating groundwater contaminant plume.
- The State requested the RP conduct a hydrogeological investigation, including analysis for heavy metals. The RP refused to do the investigation.

For these reasons, the State filed a lawsuit against RP in April 2000 to compel compliance with Part 201 and obtain cost recovery for response actions, including conducting the expanded groundwater investigation. .

VI. Five-Year Review Process

Administrative Components

The Five Year Review Process began in 2002 with U.S. EPA allocation of funds to conduct the review. MDEQ procured with State funds, a contractor to conduct the hydrogeological investigation. Written notification was given to the RP by both the Attorney General's office and the MDEQ, of the initiation of this process and the State's intention to conduct the investigation. Signed access consent forms were obtained from RP, WMI, and the majority of the private landholders on which monitoring wells were installed or where GeoProbe temporary wells would be installed. Notification to the U.S. EPA Remedial Project Manager (RPM) of the impending investigation was done via letter and phone contact. A permit to drill the temporary GeoProbe wells was also obtained from the RP.

Community Involvement and Notification

It is not clear what the current level of community interest is or if there was a public notice of the pending five-year review. This issue will be followed up when this Five-Year Review is modified to include the final protectiveness statement.

Document and Data Review

A summary of the documents reviewed for this Five Year Review is listed in Attachment C.

As a part of the Groundwater Evaluation and Optimization System (GEOS), U.S. EPA conducted an independent review of the adequacy of the pump and treat/purge system's ability to capture the target contaminant plume. This review is presented in the Draft September 8, 2003 "Analysis of Hydraulic Capture – South West Ottawa County Landfill" and the Draft September 12,2003 "Statistical Analysis Summary for the Southwest Ottawa County Landfill Site".

Conclusions and Remarks of the hydraulic capture reports include:

1. Hydraulic capture is not adequate.

2. There is insufficient data to determine how inadequate the system is operating.

3. Well pumping are important for evaluating the system, but have not been reported, even though the data have been previously requested by MDEQ.

4. Because the aquifer is relatively pervious, a shallow drawdown cone should be expected. Therefore, if near-well head observations are not obtained, the impacts of

pumping wells may not be directly observed and hydraulic capture zone analysis based on head measurements may not be reasonably accomplished.

5. The pumping wells were constructed with 10 feet of screen in the middle of an aquifer that is estimated to be 60 feet thick. This partial penetration of the aquifer must be considered when interpreting in-pumping-well data. Partial penetration is a three-dimensional effect. If the head data are interpreted as if they were two-dimensional, as is the case with head maps presented in annual reports for the Site, then the in-pumping-well data must be corrected for this three dimensional effect. These effects are estimated in Appendix B of the report to be significant for heads within the pumping wells.

6. Well losses due to reduced hydraulic conductivity near the wellbore, so-called well damage or skin effect, exist also. The last data set known that could possibly be used to determine the well damage were obtained 11 to 17 years ago. Well damage can be progressive, due to effects like encrustation and biofouling. Since there is no pumping rate information available and there is no corresponding in-well drawdown information, it is not possible to determine from the available data whether the pumping wells are in need of rehabilitation to reduce well damage. It should be noted that the partial penetration of the pumping wells leads to higher velocities at the well screen and, therefore, exacerbates well losses.

7. Estimates of heads that would be observed just outside of the pumping wells in the aquifer were calculated in Appendix B of the report to demonstrate how significant the impact of having pumping well heads would be on the interpretation of head information and system capture efficacy. The results show that including the heads within pumping wells can have a very important effect on the interpretation of heads as contour maps. In this case, the width of the inferred capture zones with in-well data is more consistent with prior hydraulic testing. Although the inclusion of these heads does not affect the principal conclusion in this case, in-well data are demonstrated to have the potential to change estimates of the degree of lack of capture.

Figure 4 and Figure 5 reproduce the results of two of the methods performed in the report. Figure 4 uses method four, an OPDATE method. This method used data provided by the RP, which did not include any groundwater elevation data for the extraction wells and an estimate of the actual rate of pumping for each extraction well. This figure clearly shows many areas of brake through. However, the areas of capture appear to be too narrow when compared to analytical calculations for determining capture. It is becoming well known that capture zones will appear too narrow if groundwater elevation data from vary close to the extraction wells are not included. Figure 5 shows the capture area when using the same OPDATE method but including derived groundwater elevation data using the method in Appendix B of the report. Although this figure also shows some brake through, the width of the capture zones are closer to what would be expected based on site conditions. Since this uses an estimate

of the elevations, this method will not determine the actual capture zone width. The rates of pumping for each well and additional groundwater level data from near the pumping well are necessary for an accurate determination of capture area. However, Figure 5 does show how important the near pumping well elevation data is.

Recommendations of the reports included:

1. Require that pumping rate data be collected and reported for each well. Monthly, or more frequent, average pumping rates for each well, for the treatment facility, for groundwaters bypassing the treatment facility, and for total system flow rate should be reported.

2. Require that a well assessment and maintenance plan be developed and require that it include an assessment of well efficiencies. Annual reports should include a section on well maintenance and efficiencies.

3. Require that in-pumping-well (and/or immediately outside the pumping well) data be collected and reported regularly. If the approach to implement this recommendation is to add monitoring wells immediately outside and adjacent to the wells at these locations, then the monitoring well screen would ideally be located opposite of the pumping well screen. It would be efficient and contribute to the execution of the well assessment and maintenance if pumping rates were measured at the same time as these heads.

4. Seek additional information east and north of the current monitoring network to improve head estimates in a region that currently has inadequate observational control.

5. Annual reports should interpret observed data to address the following questions:
    1. What is the well efficiency of each pumping well? How is that information obtained and used?
    2. What are the inferred capture zones of the pumping wells?
    3. What are the design flow rates and the actual monthly-averaged flow rates for each pumping well?
    4. Are there any trends in head, flow, or concentration data that relate to the ability of the pumping wells to perform as designed?

The methods used to address these questions, e.g., to evaluate trends, need to be fully explained and should be consistent. A synthesis of multiple lines of evidence should be provided.

6. Reassess the design pumping rates and well locations, as well as implications for the treatment plant.

7. An additional extraction well, located between PW-4 and PW-5, is needed and the total system flow rate must increase. In addition, flow rates and well efficiencies for the existing extraction wells are needed and should be evaluated prior to final decisions about new wells to determine whether the existing pump and treat/purge system will need further augmentation. Impacts of this recommendation on the treatment plant have not been evaluated.

8. If it is decided that one or more additional extraction wells is needed, then the total system flow rate must be increased and a different extraction well design should be used. Longer screens should be installed to reduce the deleterious effects of partial penetration. On the other hand, longer screens lead to greater averaging of concentrations, which may impact the rules used to determine bypass. Instead of a 10 ft screen located in the middle of the aquifer thickness, the wellbore should fully penetrate the aquifer and the well screen should extend from near the aquifer bottom to 10 feet below the water table, provided state and other regulations allow. The filter pack (also called the gravel pack or sand pack) in the annulus between the well screen or casing and the borehole wall should be sufficiently thick to allow a small diameter (e.g., 1.25 to 1.5 inches outer diameter), in-filter observation well with filter sand around it. The filter pack should extend to within 5 ft of the water table and the remaining top portion of the annulus should be backfilled with a mixture of sodium bentonite clay (either pellets or granules) with native soil from the well installation procedure. The pump inlet should be placed deep in the well, roughly 8 feet from the bottom of the well. (This allows for an electric motor below the pump and about 5 feet of clearance from the bottom of the motor to the bottom of the well.) An in-well head observation tube should be installed. Other common features, such as down-hole check valve, wellhead pressure gauge connection, and wellhead throttle valve are also recommended.

The results of the statistical analysis report are summarized in Figure 6 and 7 and Table 4. Figure 6 show the monitoring locations that have increasing trends or are getting "significantly worse". The trend tests were run using the whole set of data for each well, in most cases, from 1987 to 2001. The term significantly worse means that the last round of data exceeds the upper predication limit of a baseline time period. In this case the baseline time period is from 1988 to end of 1994 (soon after the last augmentation of the pump and treat/purge system.) Plots of the full range of data for both Diethyl Ether and Isopropyl Ether are presented for 3 wells MW-65, MW-101 and MW-103 that indicate possible brake-through. These wells are down gradient of a line that connects the groundwater extraction wells PW-3 to PW-10. The trend designation on the plots refers to trends that occurred during the baseline time period. Figure 7 shows the monitoring locations that have decreasing trends or are getting "significantly better". The term significantly better means that the last round of data exceeds the lower predication limit of a baseline time period. In this case the baseline time period is from 1987 to end of 1994 (soon after the last augmentation of the pump and treat/purge system.) Plots of the full range of data for Benzene, Diethyl Ether and Isopropyl Ether

are presented for monitoring well MW-2 and Diethyl Ether and Isopropyl Ether are presented for extraction well PW-1 and PW2. Table 4 shows a complete summary of the statistically significant findings.

Site Inspection

In October 2002, the contractor project manager (PM), the MDEQ PM and geologist conducted an on-site visit. Since access to the landfill had not been obtained, the site visit consisted of locating the off-site monitoring wells and selection of GeoProbe temporary well locations. The workplan was finalized and distributed to all interested parties in February 2003. The investigation was conducted from April through May 2003. The GeoProbe temporary wells were sampled first, followed by the monitoring wells. All the well locations were then surveyed before the GeoProbe temporary wells were removed.

All of the interested parties were given sample raw laboratory analytical results in July 2003 after the field work was completed. The contractor is completing the investigation report.

The State's assessment of the analytical data from the April/May investigation found the current pump and treat/purge system is unsuccessful in containing the entire target contaminant groundwater plume. Using this analytical data, the State located a significant groundwater contaminant plume migrating from the south and southwest corner of the landfill containing the following contaminants above criteria for both the GRA and Part 201: benzene, chlorobenzene, diethyl ether (ethyl ether), tetrahydrofuran, chromium, lead, and iron. These same contaminants were also detected in other downgradient monitoring wells at concentrations above criteria. Elevated concentrations of diethyl ether (ethyl ether), tetrahydrofuran, and iron were all detected in groundwater samples collected from sentinel wells located upgradient from the second extraction well system. These same contaminants were also detected in a sentinel well located due west and southwest of the extraction line treatment system at concentrations exceeding criteria. In 2002, similar contaminants were detected in private residential wells located along Lake Shore Drive and downgradient of the landfill. These contaminants included the following: diethyl ether (ethyl ether), tetrahydrofuran, benzene, and lead.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The remedy is not functioning as intended. The operating pump and treat system implemented under the GRA is not capturing and treating the entire plume. The last Five Year Review recommendation for the RP to demonstrate

that target capture plume was being contained has not been implemented. State suggested improvements have not been incorporated by the RP. The draft investigations conducted as part of the Five-Year Review concluded that the pump and treat system was not capturing the entire target contaminant plume. They showed that the system is allowing breakthrough of the groundwater plume in at least one location and that contaminants above criteria are migrating beyond the extraction line towards residential wells located along Lake Shore Drive. However, no hydrogeologic limiting issue has been discovered that would prevent the pump and treat system from functioning as intended. The breakthrough appears to be solely a function of groundwater hydraulics (i.e., not enough water is being removed in the correct locations.) U.S. EPA believes that the remedy would function as intended if an adequate number of extraction wells are installed and they pump at an adequate rate.

There is no well assessment and maintenance plan that includes an assessment of well efficiencies. This plan is necessary to insure that the pumping rate continue at an adequate rate.

Ottawa County has controls to prevent exposures. The RP and Park Township have completed the installation of municipal water supply system in potential receptors areas where residential wells are in use. The water supply system was installed along Lake Shore Drive, James Street and 168th Street. The Ottawa County Health Department conducts residential well sampling three times a year. The RP provides free hookup to the municipal water supply system for any contaminated residential well.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

Yes. Several of the selected contaminants and their allowable concentrations did not have an available "cleanup number" at the time GRA agreement was signed. As documented in the last Five Year Review completed in 1997, the State of Michigan has implemented Part 201 in which groundwater contaminant concentrations are compared to applicable criteria, in this instance to residential drinking water. Additional heavy metals contaminants, specifically lead and zinc, which were not listed in the GRA, have been found in the groundwater downgradient of the landfill above Part 201 criteria. These new State standards do not affect the protectiveness of the remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No

Technical Assessment Summary

According to the data collected, reviewed and the site inspection, the remedy is not functioning as intended. The operating pump and treat/purge system implemented under the GRA is not capturing and treating the entire plume. The investigations conducted as part of the Five-Year Review concluded that the pump and treat system was not capturing the entire target contaminant plume. However, no hydrogeologic limiting issue has been discovered that would prevent the pump and treat system from functioning as intended. There have been no physical changes to the site, which have contributed to the remedy failure. U.S. EPA believes that the remedy would function as intended if an adequate number of extraction wells are installed and they pump at an adequate rate.

Ottawa County has controls to prevent exposures. The Ottawa County Health Department conducts residential well sampling three times a year. The RP provides free hookup to the municipal water supply system for any contaminated residential well.

VIII. Issues

Table 2: Issues

Issues	Affects Current Protectiveness (Y/N Not Available)	Affects Future Protectiveness (Y/N)
1) Not all of the residents with wells down gradient from the SWOCLF have been hookedup to the municipal water supply.	NA	Y
2) The RP is not providing adequate information on the current operations of the pump and treat purge system and monitoring network to adequately determine remedy performance.	NA	Y
3) The operating pump and treat purge system implemented under the GRA including the source control area and the down gradient system, is not capturing and treating the entire plume.	NA	Y
4) The additional groundwater pumping required to contain the entire plume will likely require more capacity than the current treat system has.	NA	Y
5) A well assessment and maintenance plan required to insure that the pumping rate continue at an adequate rate has not been developed.	NA	Y
6) The monitoring network does not provide adequate information to determine the long-term performance of the pump and treat/purge system	NA	Y
7) Replacement of State GRA with State Administrative Order of Consent to reflect changes in the inorganic cleanup criteria found in Part 201	NA	Y

IX. Recommendations and Follow-up Actions

Table 3: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
1	Inventory all the residents with wells down gradient from the SWOCLF determine if they are still in use, on municipal water and if they have been abandoned	RP	State	12/30/03	NA	Y
1	Determine schedule for hooking up all the remaining residents with wells down gradient from the SWOCLF	RP	State	12/30/03	NA	Y
1	Hookup to the municipal water supply all the residents with wells down gradient from the SWOCLF	RP	State	12/30/04	NA	Y
1	Abandon all unnecessary wells down gradient from the SWOCLF to prevent accidental exposure.	RP	State	12/30/04	NA	Y
2	Pumping rate data must be collected and reported for each well. At a minimum, monthly average pumping rates for each well, for the treatment facility, for groundwater by-passing the treatment facility, and for total system flow rate should be reported. If historical pumping rate data is available it should be submitted	RP	State	12/30/03	NA	Y
5	A well assessment and maintenance plan be developed and implemented that includes an assessment of well efficiencies.	RP	State	12/30/03	NA	Y
2	In-pumping-well (and/or just outside the pumping well) water elevation data be collected and reported regularly. If the approach to implement this is to add monitoring wells in these locations, then the monitoring well screen would ideally be located opposite of the pumping well screen.	RP	State	4/30/04	NA	Y
2	Provide additional information east and north of the current monitoring network to improve head estimates in a region that currently has inadequate observational control.	RP	State	4/30/04	NA	Y

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
3	Reassess the design pumping rates and well locations, as well as implications for the treatment plant.	RP	State	4/30/03	NA	Y
3	Augment the pump and treat purge system (including additional extraction wells and increased total pumping) to achieve capture of the target contaminate plume. This includes the landfill source control area and the down gradient area systems. The recommendation 6) and 7) given in the Data Review portion of this Five Year Review should be adhered to. The treatment plant capacity (issue 4 needs to be addressed.	RP	State	12/30/04	NA	Y
2	Annual reports should include 1) Inferred current capture zones of the pumping wells 2) design flow rates and the actual monthly-averaged flow rates for each pumping well 3) What is the well efficiency of each pumping well? How is that information obtained and used? 4) Are there any trends in head, flow, or concentration data that relate to the ability of the pumping wells to perform as designed? 5) What is the current extent of the target contaminant plume?	RP	State	12/30/03	NA	Y
6	Augmented the monitoring network to provide the required additional information necessary to determine the long-term performance of the pump and treat purge system.	RP	State	4/30/04	NA	Y
7	Replace GRA with AOC	State	MDEQ	12/30/03	NA	Y

X. Protectiveness Statement(s)

Protectiveness cannot be determined until further information regarding current exposure pathways are obtained. The timeframe necessary make the final determinations is expected to be no more than three months. In order for the remedy to be protective in the long-term, follow-up actions need to be taken to eliminate potential threats. Long-term follow-up actions needed include: providing free municipal water supply system hookups for all potential receptors with residential wells in use; adequate information needs to be provided on the current operations of the pump and treat/purge system and monitoring network; the pump and treat/purge system needs to be augmented (including additional extraction wells and increased total pumping) to achieve capture of the target contaminant plume; and the monitoring network needs to be augmented to provide additional information on the long-term performance of the pump and treat/purge system.

XI. Next Review

The next five-year review, the fourth, should be completed by September 2007.

Attachments

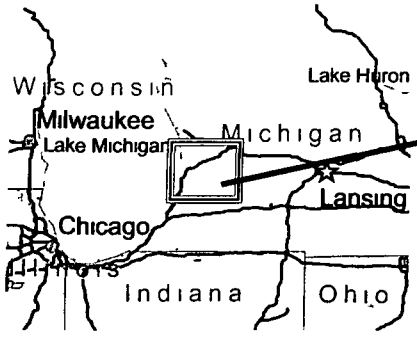
Attachment A Figure 1-7
Attachment B Table 4
Attachment C List of Documents Reviewed

Attachment A

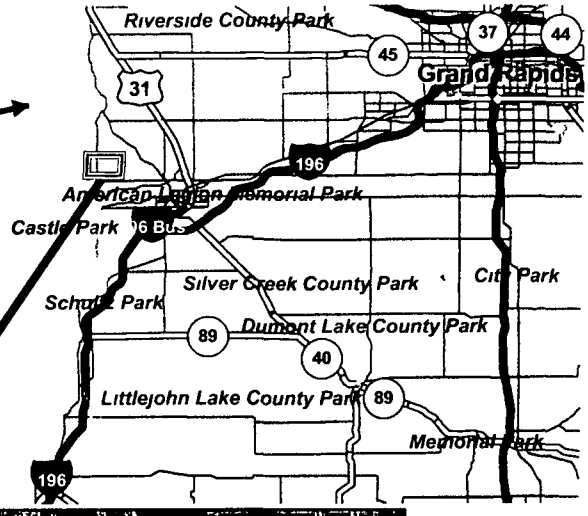
Figures

Southwest Ottawa County Landfill Site

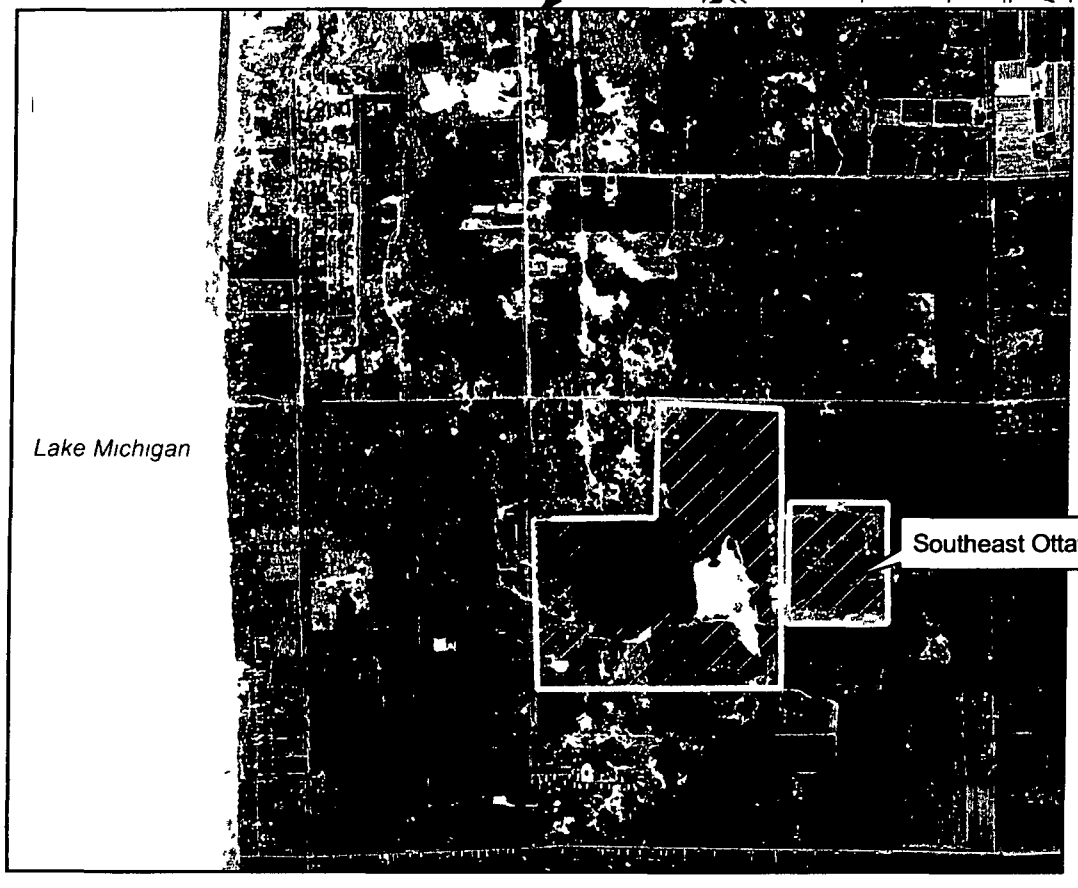
1) State



2) Ottawa County



3) Southwest Ottawa Landfill Site

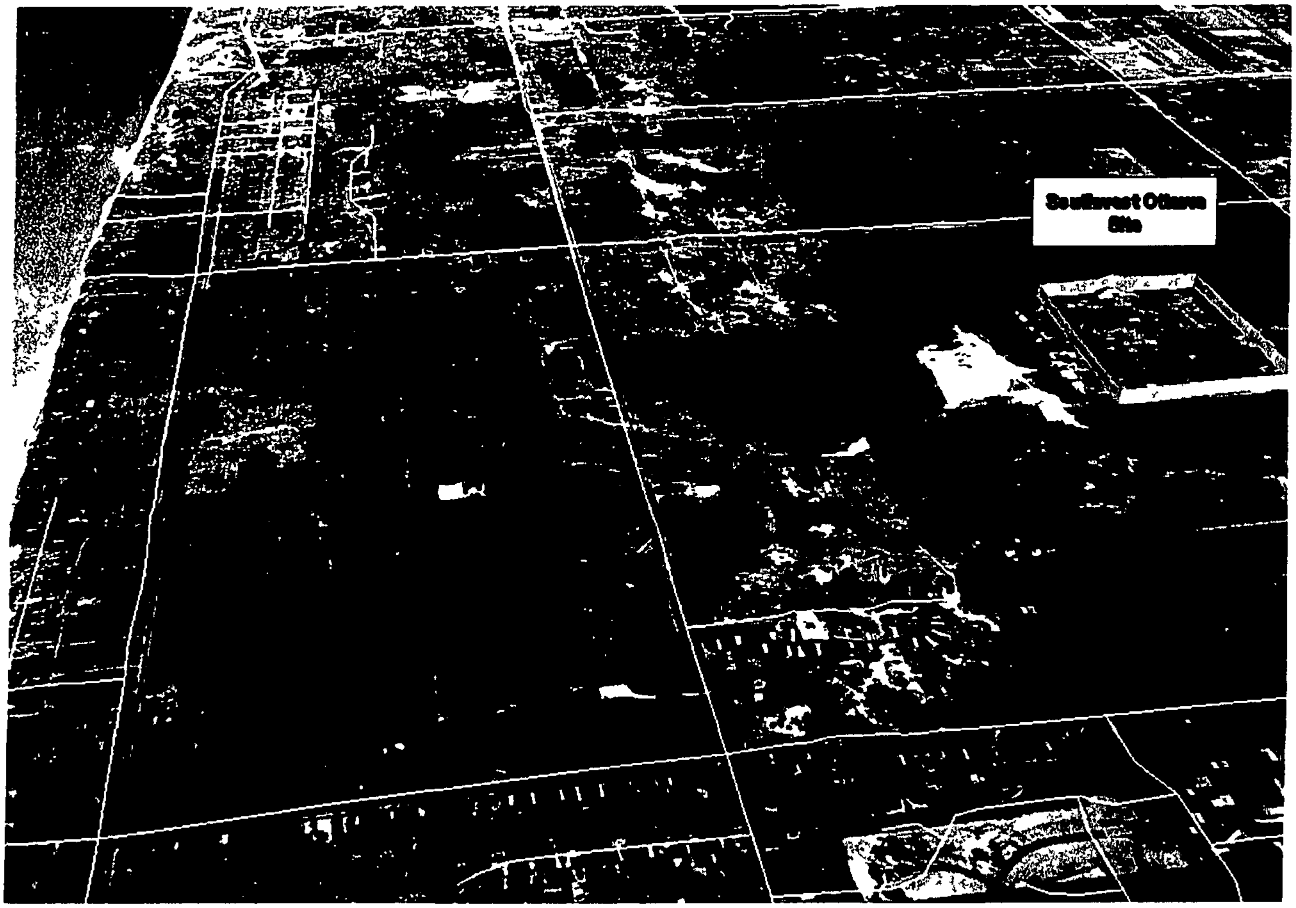


EPA Region 5 Superfund Division

Plot created by Juliana R. Prospel U.S. EPA Region 5/30/2003
B & W Image

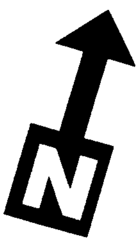
Figure 1

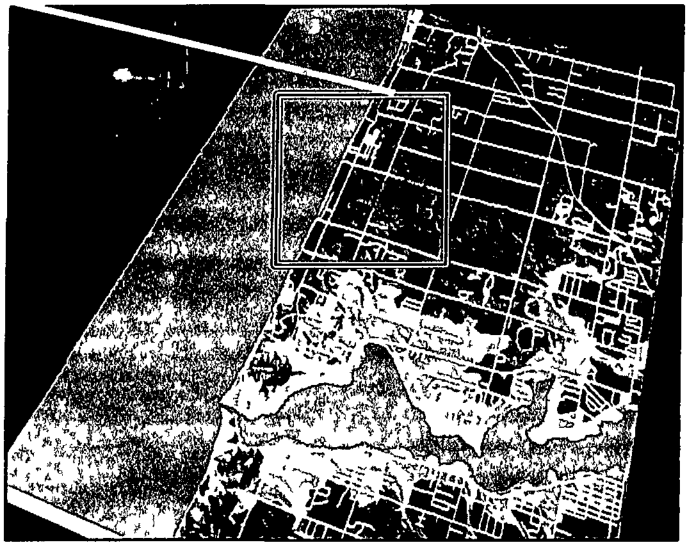
Southwest Ottawa Superfund Site
3D Surface Terrain Model



Elevation in Feet

- 769 - 793
- 745 - 769
- 721 - 745
- 697 - 721
- 674 - 697
- 650 - 674
- 626 - 650
- 602 - 626
- 579 - 602





Southwest Ottawa County Landfill

Groundwater Monitoring and Extraction Wells

- Down Gradient Extraction Well Line
- Well Locations

1,000 500 0 1,000 Feet

N

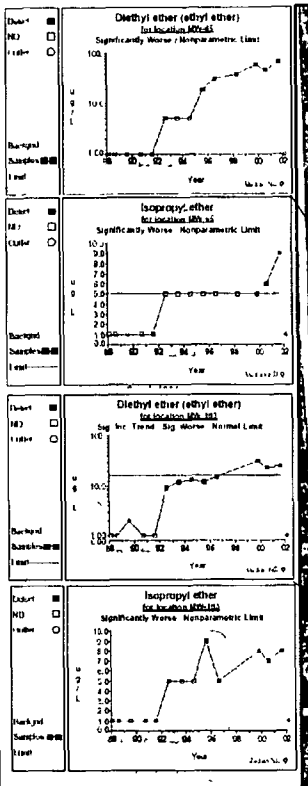
GEOS

Groundwater Evaluation and Optimization System

Created By David Wilson 9/12/2003
Color Image Date 05 04 1997

Figure 3

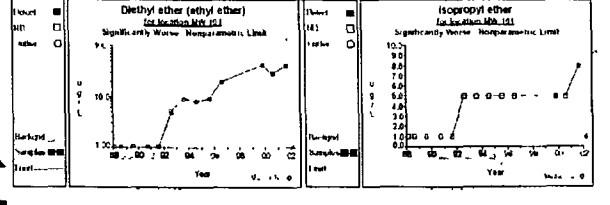
Trend Analysis for Southwest Ottawa County Landfill



Plots are shown for three wells down gradient from the extraction well line that may indicate brake through

Wells with Increasing Trends or Wells Getting Worse

- Line of Extraction Wells
- Wells Increasing Trend or Getting Worse
- All Well Locations



N

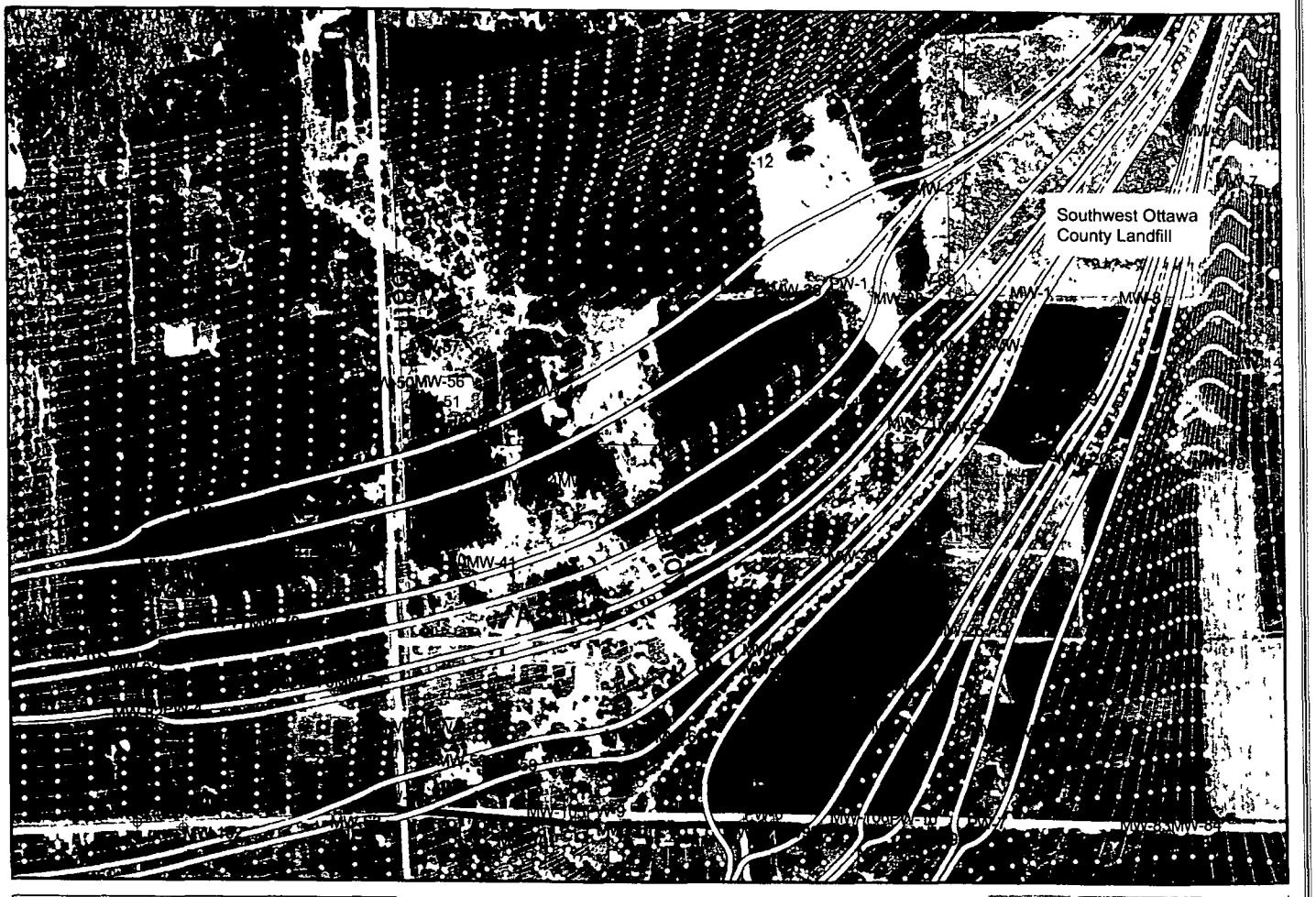
1,100 550 0 1,100 Feet

GEOS
Groundwater Evaluation and Optimization System

Created By: David Wilson 9/12/2003
Color Image Date: 05 04 1997

Figure 6

Capture Zone Analysis for Southwest Ottawa County Landfill



This analysis only used the RP provided measured elevation data. This data set did not heve elevation data for extractions wells

Area of Capture Using Only Data Provided by RP

=Capture Area

Area of Brake Through

━Down Gradient Extraction Well Line

1,000 500 0 1,000 Feet

N

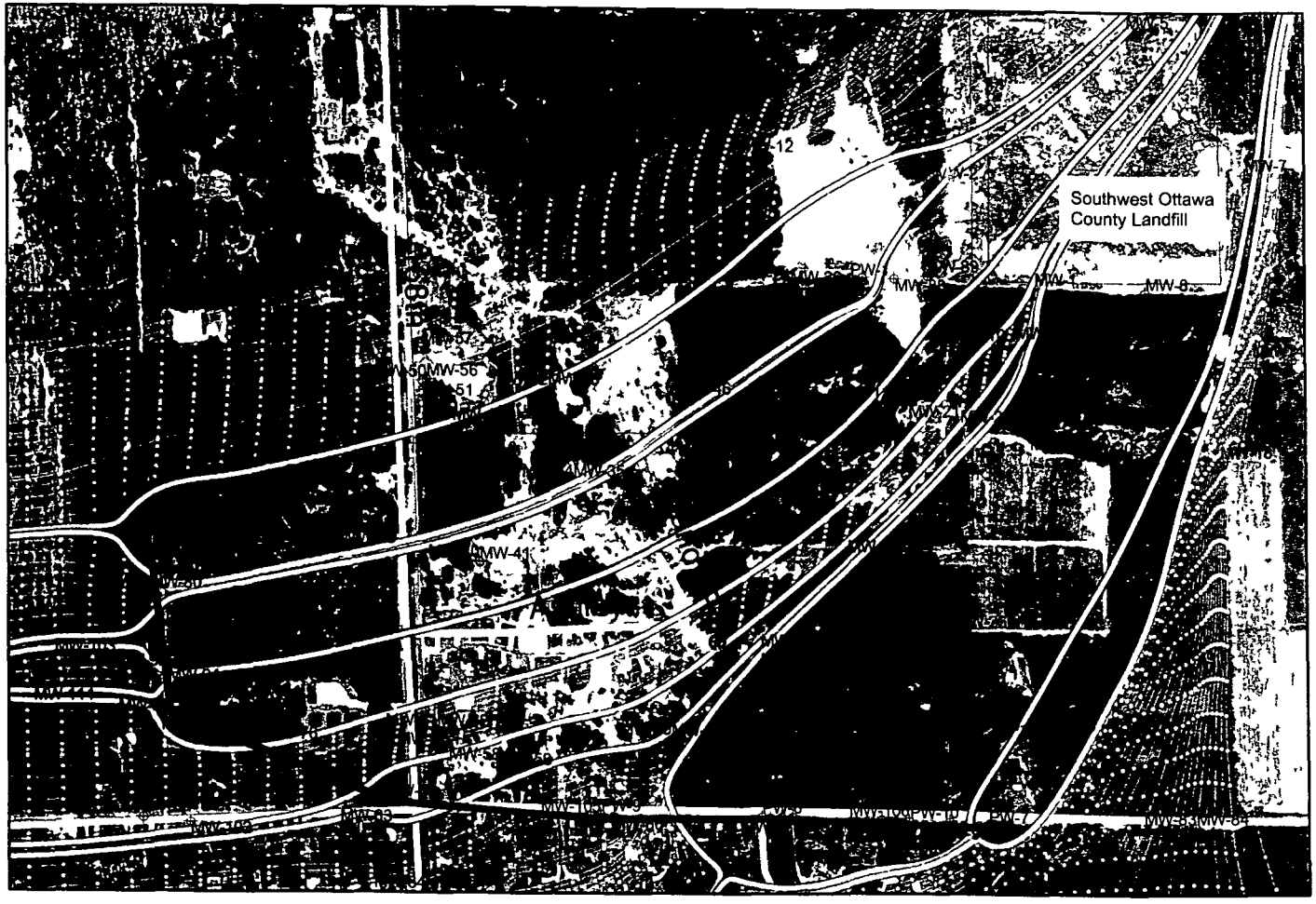
GEOS

Groundwater Evaluation and Optimization System

Created By David Wilson 9/12/2003
Color Image Date 05 04 1997

Figure 4

Capture Zone Analysis for Southwest Ottawa County Landfill



This analysis used devied data for the elevation of groundwater within the extraction wells in addtion to the the RP provided measured groundwater elevation data

Area of Capture Using Derived Data of Groundwater Elevations for Extraction Wells

=Caprure Area

Area of Brake Through

Down Gradient Extraction Well Line

1,000 500 0 1,000 Feet

N

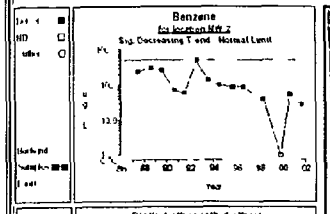
GEOS

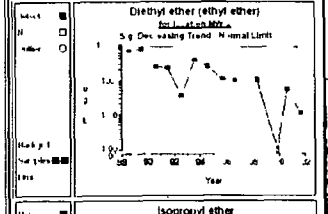
Groundwater Evaluation and Optimization System

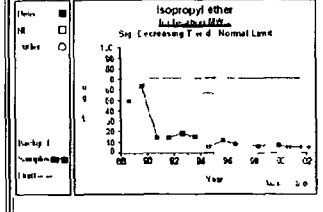
Created By David Wilson 9/12/2003
Color Image Date 05 04 1997

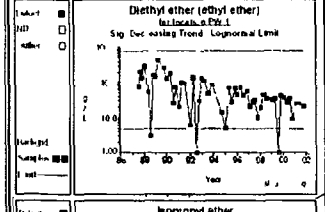
Figure 5

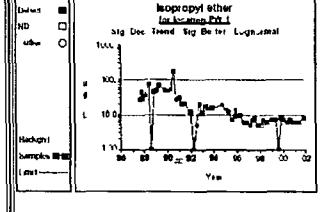
Trend Analysis for Southwest Ottawa County Landfill

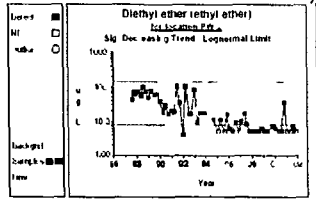


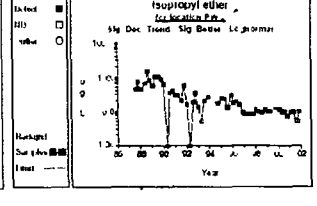












Wells with Decreasing Trends or Wells Getting Better

- Line of Extraction Wells
- Wells Decreasing Trends or Getting Better
- All Well Locations

N

1,000 500 0 1,000 Feet

GEOS

Groundwater Evaluation Optimization System

Created By David Wilson 9/12/2003
Color Image Date 05 04 1997

Figure 7

Attachment B

Table 4 Summary of U.S. EPA's Statistically Significant Findings

Well	COC	Worse	Increasing Trend	Exceeded Standard	Better	Decreasing Trend
MW-100 (removed in 2001)	Iron			X		
MW-101	Diethyl Ether	X	X	NA		
	Iron		X	X		
	Isopropyl Ether	X		NA		
MW-102	Iron			X		
	Specific conductance		X	NA		
MW-103	Diethyl Ether	X	X	NA		
	Iron	X	X	X		
	Isopropyl Ether	X		NA		
MW-107	Iron			X		
	Specific conductance			NA	X	X
MW-108	Iron			X		
	Specific conductance	X		NA		
MW-13	Iron	X	X			
MW-2	Benzene			X		X
	Chlorobenzene			X		
	Ethylbenzene					X
	Diethyl Ether					X
	Iron			X	X	
	Isopropyl Ether					X
	Specific conductance				X	
MW-28	Iron			X		
MW-30	Specific conductance	X				
MW-31	Iron		X	X		
	Isopropyl Ether		X			
MW-44	Iron			X		
	Specific conductance		X			
MW-45	Benzene			X		
	Isopropyl Ether		X			
	Iron			X		

Well	COC	Worse	Increasing Trend	Exceeded Standard	Better	Decreasing Trend
MW-52	Iron		X	X		
MW-54	Iron	X		X		
	Specific conductance	X				
MW-55	Iron			X		X
	Specific conductance					X
MW-65	Diethyl Ether	X				
	Iron	X	X	X		
	Isopropyl Ether	X				
	Specific conductance	X	X			
MW-67	Diethyl Ether	X	X			
	Iron	X	X	X		
	Specific conductance	X	X			
MW-70	Diethyl Ether	X	X			
	Iron			X		
	Isopropyl Ether	X	X			
MW-72	Iron	X	X	X		
MW-73	Specific conductance				X	
MW-77	Iron			X		
MW-8	Benzene	X		X		
	Iron			X		
MW-83	Iron	X		X		
	Specific conductance	X				
MW-84	Iron			X		
	Specific conductance	X	X			
PW-1	Benzene		X	X		
	Chlorobenzene		X			
	Diethyl Ether					X
	Iron			X		
	Isopropyl Ether				X	X
	Specific conductance					X
PW-10	Iron			X		X
	Specific conductance				X	X
PW-2	Benzene			X		X
	Diethyl Ether					X
	Iron			X		
	Isopropyl Ether				X	X

Well	COC	Worse	Increasing Trend	Exceeded Standard	Better	Decreasing Trend
	Xylenes					X
	Specific conductance				X	X
PW-3	Iron		X			
	Specific conductance				X	X
PW-4	Specific conductance		X			
PW-5	Diethyl Ether		X			
	Iron		X	X		
	Isopropyl Ether	X	X			
	Specific conductance	X	X			
PW-6	Iron		X	X		
PW-7	Specific conductance				X	X
PW-8	Diethyl Ether	X	X			
	Iron			X		
	Isopropyl Ether	X				
	Specific conductance				X	
PW-9	Iron	X		X		

Attachment C

List of Documents Reviewed

Board of County Road Commissioners Ottawa County, Michigan, Southwest Ottawa County Landfill Groundwater Remediation Reports from 1987 through 2001

Briefing Report, Southwest Ottawa County Landfill, October 2002

Leachate Purging and Treatment System Comprehensive Monitoring and Sampling Protocol Plan, Prein and Newhof, January 1992

Letter from LaRue L. Miller, MDNR, to Ronald Ruscett, Ottawa County Health Department, June 5, 1969l

MDEQ GeoProbe Investigation Results, 2000

MDNR Groundwater Sample Analytical Analysis, 1978 through 1982

MDNR Non-Compliance Letter, July 13, 1987 from Del Rector to Jack Smant

NPDES Permit, No. MI0044130, Ottawa CRC, 2485 168th Street Holland, January 7, 2002

Ottawa County Health Department Residential Well Sample Analytical, 1999 through 2002

Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended

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